

SUMMARY OF THE CLAIMS

Claims 1-6 (withdrawn)

Claim 7. (previously presented) A method of producing a semiconductor apparatus, the method comprising the steps of:

forming metal ball bumps in direct contact with a circuit pattern of a semiconductor device formed on a semiconductor substrate in a semiconductor wafer state;

forming a resin film on a circuit pattern forming surface of said semiconductor device so as to seal spaces between said metal ball bumps and to become thinner than a height of the metal ball bumps;

cleaning the surfaces of the metal ball bumps projecting out from the resin film;

after the cleaning step, forming eutectic solder layers different in composition from the metal ball bumps on the surfaces of the metal ball bumps;

after the forming solder layers step, cutting the semiconductor substrate into unit semiconductor chips, each semiconductor chip having at least one of said semiconductor device; and

after the cutting step, mounting at least one of the semiconductor chips on a mounting board from a bump forming surface side of the semiconductor chip so as to connect the eutectic solder layers of the semiconductor chip to the mounting board with the resin film directly contacting the semiconductor chip and not directly contacting the mounting board.

Claim 8. (previously presented) A process of production of a semiconductor apparatus as set forth in claim 7, wherein, in said cleaning step, the surfaces are cleaned by removing components inviting a rise in a connection resistance and a decline in a joint strength at least at a connection interface.

Claim 9. (canceled)

Claim 10. (previously presented) A process of production of the semiconductor apparatus as set forth in claim 7, wherein, in said cleaning step, any resin film components deposited on said bumps are removed.

Claim 11. (previously presented) A process of production of a semiconductor apparatus as set forth in claim 7, wherein, in said cleaning step, oxides on said bump surfaces are removed.

Claim 12. (previously presented) A process of production of a semiconductor apparatus as set forth in claim 7, wherein, in said cleaning step, the cleaning of the surfaces of the bumps is performed by plasma cleaning.

Claim 13. (original) A process of production of a semiconductor apparatus as set forth in claim 12, wherein said plasma cleaning is at least sputter etching by discharge plasma of an inert gas.

Claim 14. (original) A process of production of a semiconductor apparatus as set forth in claim 12, wherein said plasma cleaning is at least oxygen plasma treatment and then sputter etching by discharge plasma of an inert gas.

Claim 15. (original) A process of production of a semiconductor apparatus as set forth in claim 12, wherein said plasma cleaning is at least oxygen plasma treatment and then sputter etching by discharge plasma of a reducing gas.

Claim 16. (previously presented) A process of production of a semiconductor apparatus as set forth in claim 7, wherein, in said cleaning step, the cleaning of the surfaces of the bumps is performed by irradiating a laser beam.

Claim 17. (previously presented) A process of production of a semiconductor apparatus as set forth in claim 7, wherein, in said cleaning step, the cleaning of the surfaces of the bumps is performed under a reduced pressure atmosphere, an inert gas atmosphere, or a reducing gas atmosphere.

Claim 18. (previously presented) A process of production of a semiconductor apparatus as set forth in claim 7, wherein, in said cleaning step, the cleaning of the surfaces of the bumps is performed while applying a gas jet to the bumps to peel off the unnecessary components which are then sucked away.

Claim 19. (previously presented) A process of production of a semiconductor apparatus as set forth in claim 7, wherein
the metal ball bumps formed in the first step are solder bumps.

Claim 20. (previously presented) A process of production of a semiconductor apparatus as set forth in claim 19, wherein said solder bumps have a melting point higher than a melting point of said eutectic solder layers and said eutectic solder layers are comprised of a eutectic solder.

Claim 21. (previously presented) A process of production of a semiconductor apparatus as set forth in claim 20, wherein, in said forming solder layers step, the eutectic solder layers are formed by a printing method, plating method, or transfer method.

Claims 22-24. (canceled)